Physics 428 – Quantum Field Theory

Course meeting:	MTh 12:00-1:20 PM, Tech L158
Professor:	Frank Petriello
	Tech F421
	f-petriello@northwestern.edu
	Office hours: just stop by or email
Required text:	M. Srednicki, Quantum Field Theory
Recommended:	M. Peskin, An Introduction to Quantum Field Theory
	P. Ramond, Field Theory: A Modern Primer
	L. Brown, Quantum Field Theory
	S. Pokorski, Gauge Field Theories
	Itzykson and Zuber, Quantum Field Theory
Web page:	http://www.hep.anl.gov/fpetriello/physics428-fall12/index.html

Grading

Grades will be based on weekly assigned homeworks.

Syllabus

- Prerequisites: You should know the Heisenberg picture of quantum mechanics and special relativity, preferably using four-vector notation. An understanding of complex analysis and contour integrals is extremely helpful. You should be prepared for a large quantity of algebraic manipulation.

- Philosophy: We will be following the approach of Srednicki's text, which is to first introduce the concepts of QFT (scattering theory, renormalization, etc.) using scalar fields. It takes a little longer to calculate experimentally-relevant results (such as QED cross sections) with this method, but in the long-term I think it is beneficial to introduce these ideas as soon as possible.

- Techniques for study: It is extremely helpful to refer to several texts when trying to learn QFT. When a topic is unclear in one text, another book might describe it in a way that resonates with you. Several textbooks are on reserve in the physics library.

- Units: I will be using the natural units $\hbar = c = 1$ ASAP. A discussion of this is given in section 12 of your textbook.

- <u>The metric</u>: The standard choice for the metric tensor in particle physics is $g_{\mu\nu} = \mathrm{diag}\,(+1, -1, -1, -1)$. Your textbook uses $g_{\mu\nu} = \mathrm{diag}\,(-1, +1, +1, +1)$. This leads to a few annoying sign differences in formulae that I will attempt to point out and fix.

- <u>Tentative outline</u>: I plan to begin the class by discussing the following sections of Srednicki's text: $1, 3 - 12, 14, 16 - 21, 25 - 29$. After covering these we'll move onto spinor fields; the sections covered will depend on the time remaining in the semester.